

Memo

Date 28 February 2013
To Westley Owers
Copy Marina Mickaeal
Alex Cockerill
From Toby Lambert
Ref 2110501BME_0588
Subject Addendum Ecological Assessment of Hexham Relief Roads including Private Access Track

Dear Westley

1. Introduction

The Hexham Relief Roads Project is part of the Hunter Valley rail infrastructure improvements program that aims to increase rail capacity on the main northern railway line to support future increase in coal exports from the region. An ecological assessment has been completed for the Hexham Relief Project as part of the Environmental Impact Statement (EIS) and will be assessed under the Part 5.1 of the NSW *Environmental Planning and Assessment Act 1979*.

There has been several design changes made since the ecological assessment for the Hexham Relief Roads project has been written by Parsons Brinckerhoff in April 2012. These design changes outside of the original study area include the following and the overall locations are depicted in Figure 1:

- the construction of a combined UHVA/Queensland Rail site compound
- construction access road at the Tarro Interchange to extend to Woodlands Close for access to the proposed site compound
- the extension and minor realignment of a swale drain
- a private access track, including nominated impact (disturbance) areas
- an area to the east of the existing rail corridor for proposed minor signalling works
- the lowering of the rail tracks over approximately 820 metres
- the reduction in native habitat impacts due to further refined design changes.

The lowered tracks do not alter the horizontal alignment of the tracks or the Project footprint. The vertical alignment outside of the lowered area remains as shown in the EIS design. The proposed rock formation is consistent (same quantity and composition) as shown in the EIS design.

More specific location of these project additions are shown in the enclosed Figures 1a-1f and Figures 2a-2d.

An Addendum Ecological Assessment for the additional potential impacts outside the original study area, and as listed in the points above, is required. This addendum ecological assessment has therefore been prepared to assess these additional impacts and provide revised vegetation removal figures for the Hexham Relief Project.

This technical memo is to be provided as an addendum to the EIS.

2. Methodology

Desktop analysis of the vegetation in the addendum study area was conducted before the additional site inspection to enable targeting areas of potentially significant native vegetation that may be affected by the proposed freight corridor. Lower Hunter and Central Coast Regional Environmental Management Strategy (2003) was consulted before the site inspection to identify any potential endangered ecological communities that might be present within the addendum study area. The previous ecological assessment completed by Parsons Brinckerhoff (2012) was also consulted before the site inspection to gain an understanding of the potential vegetation that may occur within the addendum study area. No updated database searches have been conducted as the previous database searches provided for the EIS are relatively recent (February 2012).

The combined addendum study area is shown in Figure 1. The enclosed Figures 1a – 1f show more specific design aspects (excluding private access track). Additional field surveys conducted for the private access track occurred within a 25 m buffer around the centre of the proposed location (as shown in the enclosed Figures 2a to 2d). It should be noted that the assessed impact is variable, ranging from a maximum of 5 m in width in sensitive areas to the full 25 m in those areas dominated by exotic or cleared vegetation types. In sensitive areas, the impact zones are also limited to those areas dominated by exotic or cleared vegetation types. This is reflected in the impact areas shown on Figures 2a to 2d.

One Parsons Brinckerhoff ecologist, Deborah Landenberger, undertook site inspections on the 23 October and 19 December 2012 to verify the desktop analysis. The 23 October inspection targeted all the known project additions at that time. The 19 December inspection targeted the private access track. Results presented in this report have been presented separately for both components for ease of reference where necessary.

The survey effort targeted all vegetation within the addendum study area and included surveys on foot and vehicle. The floristic diversity and possible presence of Threatened species of plant was assessed using the random meander technique as described by Cropper (1993).

Fauna habitat assessments were also undertaken to assess the likelihood of Threatened species of animal occurring within the addendum study area and a general fauna features traverse was undertaken to identify additional species and their habitats. During the traverse, opportunistic recordings of species were made through incidental sightings, aural recognition of calls, and observing indirect evidence of species' presence (e.g. scratchings, whitewash).

All work was carried out under the appropriate licences, including a scientific licence (SL100630) as required under Clause 22 of the National Parks and Wildlife Regulations 2002 and Section 132C of the *National Parks and Wildlife Act 1974*.

3. Field survey results

3.1 Vegetation mapping

Lower Hunter and Central Coast Regional Environmental Management Strategy (2003) has mapped three vegetation communities as occurring either within or in the immediate vicinity of the addendum study area. These communities are all listed as endangered under the *Threatened Species Conservation Act 1995* (TSC Act). These include the following:

- Freshwater Wetland Complex listed as Freshwater Wetlands on Coastal Floodplains.
- Swamp Mahogany Paperbark Forest listed as Swamp Sclerophyll Forest on Coastal Floodplains.
- Swamp Oak Rushland Forest listed as Swamp Oak Floodplain Forest on Coastal Floodplains.

Groundtruthing of the addendum study area identified two modified vegetation communities and four native vegetation community these as listed below and depicted in the enclosed Figures 1a-1f and Figures 2a to 2d.

- Coastal Saltmarsh in Estuaries.
- Swamp Mahogany Swamp Forest on Coastal Lowlands.
- Swamp Oak Swamp Forest Fringing Estuaries.
- *Phragmites australis* and *Typha orientalis* Coastal Freshwater Wetlands.
- Exotic Herbfield.
- Exotic Grassland/Disturbed.

Of these vegetation communities, the latter three were found to occur within the study area specifically for the private access track. All of the vegetation communities were recorded within the combined project additions.

A description of these vegetation communities are provided in the ecological assessment (Parsons Brinckerhoff 2012) provided in the EIS.

3.2 Fauna habitats

3.2.1 Project additions (excluding private access track)

The fauna habitats present within the addendum study area were restricted to cleared land (comprising both the exotic herbfield and exotic grassland/disturbed) with a managed understorey, effectively removing ground cover and understorey habitat which provides both foraging and shelter resources for fauna. This cleared land lacked a range of habitat features such as tree hollows, leaf litter, fallen timber and moderate shrub layer that would potentially support a more diverse fauna. The condition of this habitat was considered poor due to the removal of microhabitat structures through clearing, grazing and maintenance practices.

The aquatic habitat includes a large dam which could be ephemeral in times of drought but the edge of the dam was dominated by sedges and exotic grass species. This water body provided habitat for frogs, waterbirds and resident waders, as well as providing a source of water for other vertebrate fauna. This habitat will not be impacted upon by the proposed drainage swale.

3.2.2 Private access track

Cleared Land

The fauna habitats present within the private access track study area was comprised of cleared land (including both the exotic herbfield and exotic grassland/disturbed), swamp forest and aquatic habitat. The cleared land contained a managed understorey, effectively removing ground cover and understorey habitat which provides both foraging and shelter resources for fauna. This cleared land lacked a range of habitat features such as tree hollows, leaf litter, fallen timber and moderate shrub layer that would potentially support a more diverse fauna. The condition of this habitat was considered poor due to the removal of microhabitat structures through clearing, grazing and maintenance practices.

Aquatic habitat

The aquatic habitat includes freshwater wetlands which could be ephemeral in times of drought, although the edge of this community was dominated by sedges and exotic grass species. The aquatic habitat provides habitat for frogs, snakes, waterbirds and resident waders, as well as providing a source of water for other vertebrate fauna.

Swamp Forest

The swamp forest habitats (Swamp Mahogany Swamp Forest and Swamp Oak Swamp Forest) consisted of *Eucalyptus robusta* and *Melaleuca ericifolia* with monotypic stands of *Casuarina glauca*. Such canopy species would provide flowering resources for nectivorous birds and mammals. No tree hollows were observed in this habitat. However, due to the role of remnant vegetation in providing connectivity amongst the surrounding fragmented landscape, this habitat was considered to have a moderate value to those more mobile species of fauna (i.e. bats and birds). The swamp forest contained habitat for commonly occurring reptiles and small passerine bird species.

Swamp forest generally lacked a shrub layer due to the current grazing regime and where understorey did occur it consisted predominately of Lantana, Acacia sp. and other exotic species. The ground cover mainly consisted of exotic grasses and leaf litter was scarce. No fallen timber/woody debris was recorded in this habitat.

4. Threatened biodiversity and migratory species

4.1 Flora

Surveys did not reveal any threatened species of plant or populations within the addendum study area. Potential habitat for five threatened flora species occurs within the combined addendum study area (Table 1).

Table 1 Threatened flora and their habitats within the study area

Threatened Flora Species	Swamp Mahogany Swamp Forest on Coastal Lowlands	Swamp Oak Swamp Forest fringing estuaries	<i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands	Exotic Herbfield	Exotic Grassland/ Disturbed
<i>Asperula asthenes</i>	✓	✓	✓	✓	-
<i>Lindernia alsinoides</i>	✓	✓	✓	✓	-
<i>Maundia triglochinos</i>	-	-	✓	✓	-
<i>Persicaria elatior</i>	✓	✓	✓	✓	-
<i>Zannichellia palustris</i>	-	-	✓	-	-

These potential habitats will not be impacted upon by the proposed drainage swale, other project additions or the private access track.

4.2 Fauna

No threatened fauna species were recorded within the addendum study area during the current surveys. The threatened fauna species Grey-headed Flying Fox, White-fronted Chat, Black-necked Stork and Spotted Harrier have been previously recorded either within or near the Project area by Parsons Brinckerhoff (2012). The habitats present within the areas covered by this addendum ecological assessment are not likely to form important habitat for these, or other, threatened fauna.

4.2.1 Tarro Interchange and northern compound area

The Tarro Interchange Disturbance Area traverses across low-lying areas characterised by exotic herbfield vegetation. The low-lying nature of the traversed flats is subject to inundation during prolonged wet periods and as such may be utilised by a range of waterbirds, including resident and migratory species. The presence of sustained water in these areas may also provide some ephemeral foraging opportunities for threatened waterbirds, such as the Australian Painted Snipe and the Australasian Bittern.

Where exotic grassland/disturbed occurs across the Interchange Disturbance Area and the Northern Compound Area, there is little habitat for more than common open country birds and introduced mammals.

4.2.2 Swale drain area

Habitat in the Swale Drain Area is low-lying and as such may provide habitat for waterbirds during wet periods. Receding waters in the Swale Drain may provide foraging opportunities for resident and migratory waterbirds.

4.2.3 Additional area for signalling

Habitat in the area was exotic herbfield and found to contain no important habitat for fauna.

4.2.4 Private access track

The private access track will traverse cleared land habitat and disturbed areas which contains little habitat apart from for some open country birds, macropods and introduced mammals. The habitats present within the areas covered by this ecological assessment are not likely to form important habitat for these, or other, threatened fauna.

The swamp habitat provides potential habitat for a number of threat-listed species, including Swift Parrot, Black Bittern and Australasian Bittern. Furthermore, *Eucalyptus robusta*, is listed as a primary feed tree species for Koala, as listed under the approved Koala Recovery Plan (Department of Environment and Climate Change 2008). This habitat and its integrity will not be impacted upon by the proposed access track.

Aquatic habitat in the Study Area provided potential habitat for threatened species, including Green and Golden Bell Frog, Australasian Bittern and Black-necked Stork, as well as and migratory species, including Latham's Snipe and other freshwater shorebirds. This habitat and its integrity will not be impacted upon by the proposed access track.

4.3 Migratory species

The current field surveys did not record any migratory species however the previous field surveys for the ecological assessment of Hexham Relief Roads recorded three species of bird listed as Migratory under the EPBC Act, being, the Eastern Great Egret, Cattle Egret and White-bellied Sea-Eagle within the original study area. Analysis of database searches identified a further 34 (terrestrial, wetland and marine) have the potential to occur within the locality (10 km radius). Of these 25 migratory species have a moderate or greater likelihood of occurrence (Parsons Brinckerhoff 2012). This is due, in large part, to the original study area's location within the Hunter River floodplain and proximity to suitable migratory bird habitat. While a number of terrestrial, wetland and marine Migratory species of bird may potentially use the area, ecological assessment for Hexham Relief roads did not classify the original study area as 'important habitat' (refer to Section 4.4 of the ecological assessment for Hexham Relief Roads) as defined in the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of the Environment Water Heritage and the Arts 2009). As an overall reduction in habitat removal for migratory species has occurred due to detailed design changes, the assessment outlined in Section 4.4 of the Ecological Assessment for the Hexham Relief Roads project is not likely to change as a result of the current design changes outlined in this Section 1 of this Addendum Ecological Assessment. The additional habitat removal of cleared land for the private access track, which provides limited habitat for migratory species, is also not likely to change the outcomes of the previous assessment in the Ecological Assessment for the project.

4.4 Endangered populations

No endangered populations were recorded within the original or combined addendum study area or are considered likely to occur (refer to Section 4.2 Parsons Brinckerhoff 2012 for further information).

4.5 Ramsar wetlands and SEPP 14 wetlands

4.5.1 Project additions (excluding private access track)

The current design change and the addition of the access road and site compounds occur outside of the mapped SEPP 14 wetlands, Wetlands of National Importance and the Ramsar Wetlands (Refer to Section 4.5 Parsons Brinckerhoff 2012 for further information).

4.5.2 Private access track

The formalisation and construction of the private access track in some cases may occur just inside the mapped boundaries of a SEPP 14 wetland.

However, ground-truthing of these areas revealed that the vegetation was identified as exotic grassland only and was not consistent with a freshwater wetland or any related EEC.

The private access track footprint is located outside of any Wetlands of National Importance and the Ramsar Wetlands (Refer to Section 4.5 Parsons Brinckerhoff 2012 for further information).

The western boundary of the private access track is to be located within 25 m of the Hexham Swamp Nature Reserve. This access track has been located in this position to avoid disturbing contaminated soil which may produce contaminated runoff into the adjoining Hexham Swamp Nature Reserve. Currently an existing drainage ditch and access road for Hunter Water Corporation exists between the proposed access road and Hexham Swamp Nature Reserve (Photo 1). Any sediment runoff from the road construction works would be contained within this road side ditch and therefore prevent runoff from entering Hexham Swamp. In addition the mitigation measures outlined in Section 6 of the Ecological Assessment report will be adhered to.



Photo 1 Hexham Swamp Nature Reserve and Hunter Water easement

4.6 Threatened Ecological Communities

4.6.1 Project additions (excluding private access track)

The vegetation community of *Phragmites australis* and *Typha orientalis* Coastal Freshwater Wetlands is commensurate with Freshwater Wetlands on Coastal Floodplains listed as endangered on the TSC Act.

No vegetation communities present within the addendum study area are commensurate with any threatened ecological community listed on the *Environment Protection Biodiversity Conservation Act 1999*.

4.6.2 Private access track

Four endangered ecological communities, listed under the TSC Act, have been recorded within the addendum study area. These include the following:

- Coastal Saltmarsh in Estuaries is commensurate with Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions as listed on the TSC Act.
- *Phragmites australis* and *Typha orientalis* Coastal Freshwater Wetlands is commensurate with Freshwater Wetlands on Coastal Floodplains as listed on the TSC Act.
- Swamp Mahogany Swamp Forest on Coastal Lowlands is listed as Swamp Sclerophyll Forest on Coastal Floodplains as listed on the TSC Act.
- Swamp Oak Swamp Forest Fringing Estuaries is commensurate with Swamp Oak Floodplain Forest on Coastal Floodplains as listed on the TSC Act.

No vegetation communities present within the addendum study area are commensurate with any threatened ecological community listed on the *Environment Protection Biodiversity Conservation Act 1999*.

5. Impacts

The proposed design changes will not result in any new type of impacts to biodiversity compared to the Hexham Relief project assessed in the Ecological Assessment prepared by Parsons Brinckerhoff (April 2012). It will, however, change the extent or magnitude of the impacts to a minor degree, namely the extent of vegetation clearing and associated loss of habitat. These are described below.

The private access track will generally follow existing unformed access tracks and will be restricted to exotic grassland or previously disturbed vegetation. It will, however, change the extent or magnitude of the impacts to a minor degree, namely the extent of exotic vegetation clearing and associated loss of habitat for commonly occurring flora and fauna species. As shown in Figures 2a – 2d, specific areas have been identified in which impacts from the track formalisation construction may be expected. It is considered likely that the identified 'impact' areas are an overestimate of total impacted area, although this approach provides flexibility to the construction team, while still providing absolute protection to all and any areas of identified EEC and associated wetland vegetation. The identification of impact areas also allows quantification of impacts to be identified and provides defined areas to the construction team in which works are acceptable.

5.1 Vegetation clearing

The proposed site compound, private access track and drainage swale would result in 19.32 ha of vegetation removal including:

- 0.05 ha of Swamp Oak Swamp Forest Fringing Estuaries (listed as endangered under the TSC Act).
- 19.27 ha of exotic vegetation (comprising of Exotic Grassland/Disturbed and Exotic Herbfield vegetation).

The vegetation clearing associated with the proposal is outlined in Table 2. In addition to this clearing an overall documented reduction in native vegetation clearing has been achieved through the more detailed design process which has reduced the original impact upon native vegetation within the combined new study area. This reduction has resulted in an overall reduction in the removal of threatened native vegetation communities by 1.95 ha (Table 2).

Table 2 Potential loss of vegetation within the combined new study area

Vegetation community	Extent within combined new study area (ha) inclusive of proposed access track	Vegetation clearing (ha) for the original EIS assessment	Revised total vegetation clearing (ha)
Swamp Oak Swamp Forest Fringing Estuaries ¹	7.21	5.28	4.02
Swamp Mahogany Swamp Forest on Coastal Lowlands ¹	1.64	1.12	1.11
<i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands ¹	4.92	2.70	2.02
Coastal Saltmarsh in Estuaries ¹	1.63	0	0
Exotic Grassland/Disturbed	57.61	25.55	34.19
Exotic Herbfield	10.97	3.70	3.91
Planted Vegetation	2.72	0.69	0
Total	86.70	39.05	45.25
Total area of EEC	15.40	9.10	7.15²

Notes:

1 – Endangered Ecological Community as listed under the *Threatened Species Conservation Act 1995*

2 – Includes private access track and other project additions

5.2 Fauna habitat

Approximately 19.32 ha of fauna habitat will be removed as part of the design amendments including 0.05 ha of swamp forest and 19.27 ha of cleared land. This will result in the loss of a small area of potential feeding and roosting resources for fauna. It is unlikely to provide breeding habitat and would be of limited value as feeding habitat for threatened species of animals. No mature or hollow-bearing trees will be removed as part of the modified design. Subject to mitigation measures provided in the Ecology Assessment (April 2012) for the EIS and comments in Section 7 below, no significant fauna habitat is likely to be affected by the additional rail corridor area or private access track works.

Given the changes in swamp forest (the most important fauna habitat) has been reduced for the proposal, the impacts to fauna are unlikely to be significantly different from the ecological assessment for the Hexham Relief project prepared by Parsons Brinckerhoff in April 2012. Table 3 outlines the amended habitat loss as a result of design changes including site compound, access track and drainage swale.

Table 3 Fauna habitat loss as a result of the proposal

Fauna habitat	Extent within combined new study area (ha) inclusive proposed access track	Fauna habitat clearing (ha) for the original EIS assessment	Total fauna habitat (ha) removal as a result of design changes	Total fauna habitat clearing (ha) as a result of access track inclusion
Swamp forest	11.57	7.10	5.13	5.13
Saltmarsh	1.63	0	0	0
Aquatic habitat	4.92	2.70	2.02	2.02
Cleared land	68.58	29.25	27.0	38.10
Total Fauna Habitat	86.70	39.05	34.15	45.25

5.3 Threatened biodiversity

Significance assessments were carried out for three threatened flora species, 26 threatened fauna species, and four threatened ecological communities as part of the previous ecological assessment. For the current design changes additional impact assessments are not required as the impacts to native habitats have been reduced and no new species or communities have been impacted upon by the proposal.

These assessments from the previous ecological assessment concluded that the project would not be likely to have a significant impact on any threatened biodiversity, nor would it interfere with their recovery, assuming that a range of mitigation measures were put in place. The results of this current survey for the additional areas of the access tracks, site compound and swale drain are not likely to change the outcome from the previous assessment.

5.4 Groundwater Dependent Ecosystems

The likely impacts upon Groundwater Dependent Ecosystems (GDEs) are covered in detail in Section 5.10 of the Ecological Assessment by Parsons Brinckerhoff (April 2012). Consideration of potential changes in impacts to GDEs as a result of the project additions is however warranted, given that all of the wetland EECs have been previously reported as being groundwater dependent. Impacts to GDEs as a result of previous project designs were not considered likely to be significant in the Ecological Assessment.

The latest specialist advice from Coffey Geotechnics (2013) indicates that in relation to GDEs, groundwater drawdown is not expected to extend significantly beyond the construction formation at the location of the SEPP 14 wetland. Therefore, according to Coffey Geotechnics (2013), the SEPP 14 wetlands are not expected to be impacted by groundwater drawdown outside the footprint of the Relief Roads. Similarly, Coffey Geotechnics (2013) indicates that the project is assessed to have no groundwater-drawdown-related impact on GDEs.

The potential impacts to the SEPP 14 wetland and GDEs have also been previously assessed and are considered to be unlikely to be significant given the current poor condition of this area already significantly affected by the historical disturbance associated with the coal loading facility, placement of fill and altered drainage systems with the existing rail corridor. Any short-term fluctuations of the pre-construction groundwater levels are not considered likely to result in substantive changes to habitat type outside of the direct impact areas already assessed.

6. Consistency with the previous design and Ecological Assessment (April 2012)

6.1 Consistency relating to threat-listed biodiversity

The ecological assessment for the Project considered the potential impacts to threatened biodiversity and these assessments determined that the project would not have a significant impact on threatened biodiversity. The proposed additional site compound, private access track and drainage swale will result in clearing of 0.05 ha of swamp forest and 19.27 ha of cleared land vegetation and associated habitat. As a result of significant design changes within the project there has been an overall decrease in native vegetation and habitat clearing and therefore the amended project is not likely to have a significant impact on threatened biodiversity.

6.2 Consistency with impacts to EPBC Act listed biodiversity

No additional impacts to the EPBC Act listed ecological communities, or EPBC Act listed species, will occur as a result of the amendments to the project footprint.

7. Conclusions

Field surveys were undertaken on the 23 October and 19 December 2012 to identify the biodiversity values of the addendum study area.

The proposed additional site compound, private access track and drainage swale will not result in new types of impacts to biodiversity compared to the previous ecological assessment for the Hexham Relief Project. They do, however, change the extent of the impacts to a small degree, namely the extent of vegetation clearing and associated loss of habitat. Of the 19.32 ha additional impact area, less than 1% of this is native vegetation. Whilst the vegetation and habitat removal has increased in the areas for the additional site compound, private access track, drainage swale and signalling works, modifications to the design of the project has resulted in an overall reduction in the native vegetation and habitat to be removed.

The proposed private access track mostly follows existing tracks or alternatively occurs in cleared areas. The access track will result in the removal of modified exotic habitats only, which provide limited habitat for threatened biodiversity. Specific impact areas have been identified for the track formalisation and construction phase, and these are completely located with existing disturbed / exotic habitats. Protection of any proximate wetland or EEC areas will occur as a result.

The potential impacts to threatened biodiversity have been reduced and therefore adequately covered by the previous impact assessments and no additional significance assessments are required. The project, including additional impacts, is unlikely to have a significant impact on biodiversity. In addition, an offset strategy is to be agreed with the Office of Environment and Heritage and it is expected that this will result in a net improvement in conservation outcomes for threatened species and endangered ecological communities.

Finally, the mitigation measures provided in the Ecological Assessment by Parsons Brinckerhoff (April 2012) and the Environmental Impact Statement are still current and suitable to provide additional mitigation for the impacts of the Project.

Yours sincerely



Toby Lambert
Principal Ecologist
Parsons Brinckerhoff

Encl:

Figure 1a-1f Tarro Interchange Site Access and Compound Vegetation Communities
Figure 2a-2d Private Access Track Vegetation Communities

References

Coffey Geotechnics (2013) Groundwater Assessment Hexham Relief Roads, Upper Hunter Valley Alliance

Cropper, S. C. (1993). Management of Endangered Plants. Melbourne, CSIRO Australia.

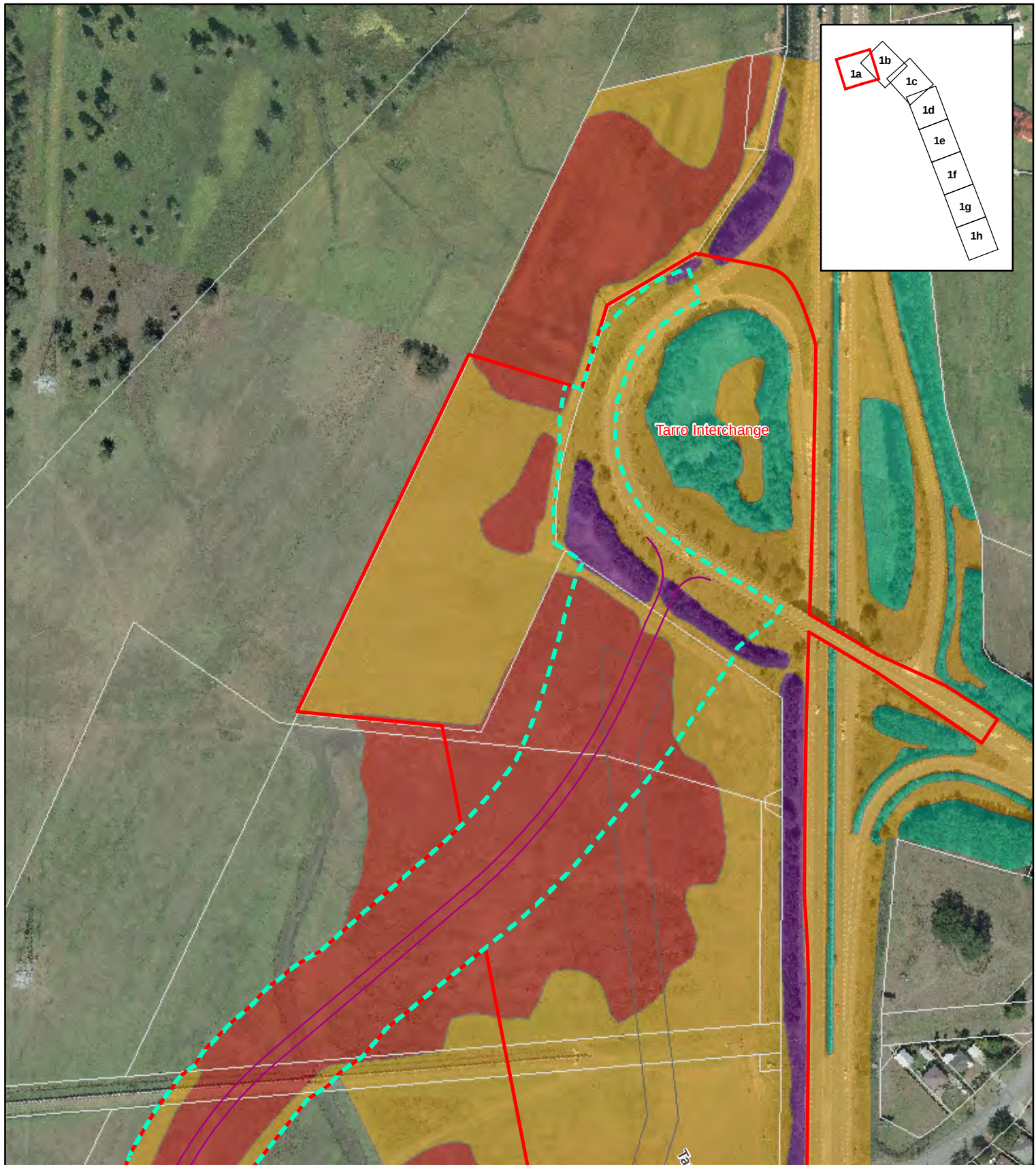
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Lower Hunter and Central Coast Regional Environmental Management Strategy (2003). Lower Hunter Central Coast Extant Vegetation Community Map. Thornton, Lower Hunter and Central Coast Regional Environmental Management Strategy.

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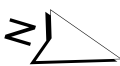
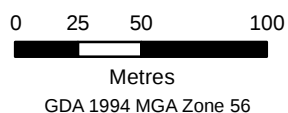
Figure 1a-1f

Tarro Interchange Site Access and
Compound Vegetation Communities



- Jemena Gas Pipeline - Tarro Interchange Access - Project Area - Cadastre	- Relief Roads - Swale Drain - Vehicular Access - Indicative Tarro Interchange Disturbance - Compound Area	Vegetation Communities - Coastal Saltmarsh in Estuaries - Exotic Grassland / Disturbed - Exotic Herbfield - Planted Vegetation - Water	<i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands - Swamp Mahogany Swamp Forest on Coastal Lowlands - Swamp Oak Swamp Forest Fringing Estuaries
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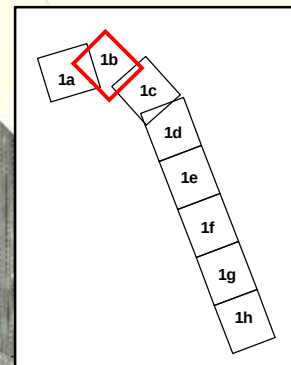
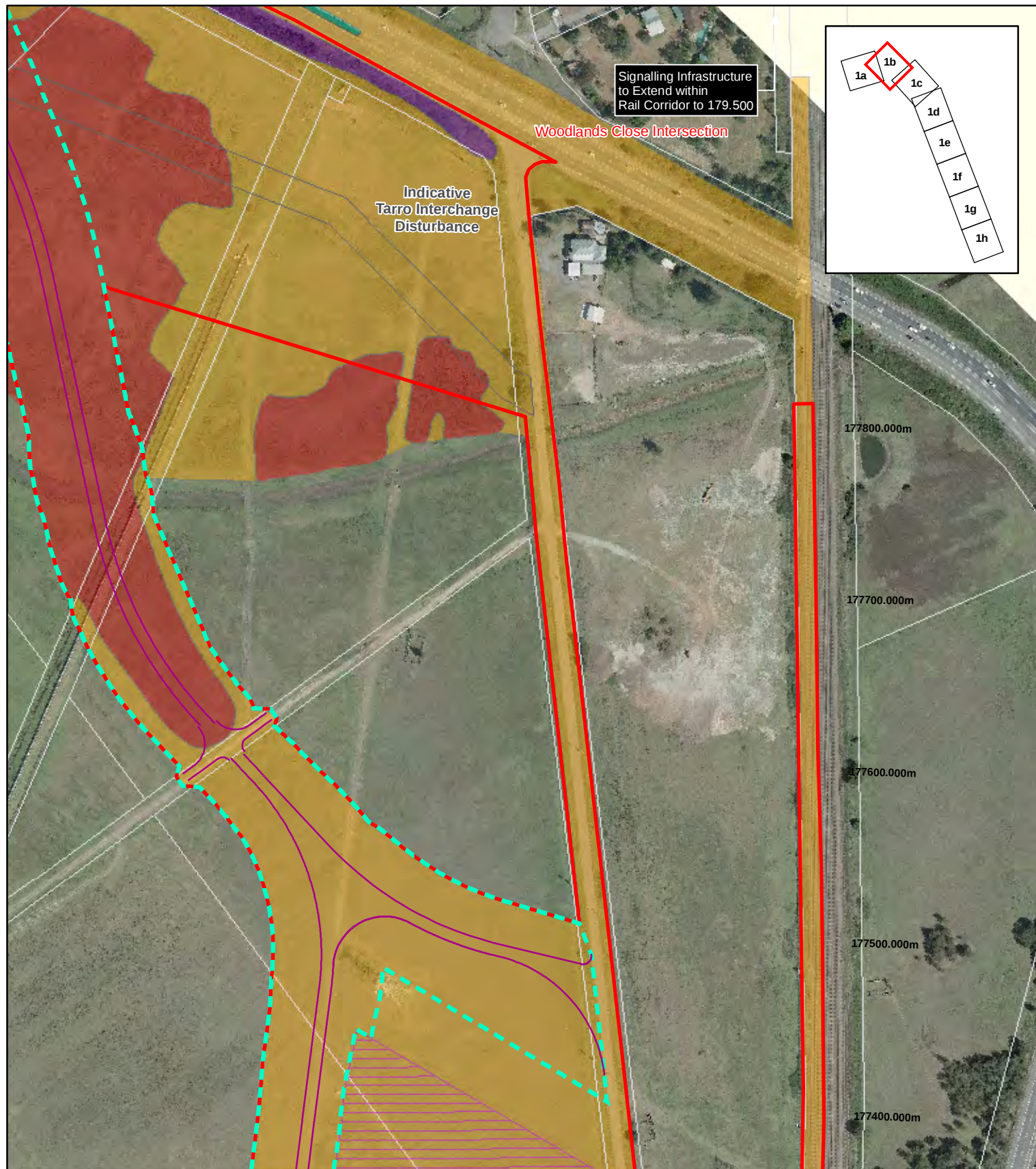


ARTC
Hexham Relief Roads

Tarro Interchange Access and Site Compound Vegetation Communities

Job Number	2110501B
Revision	A2
Date	02.11.2012
Scale	1:3,000

Figure 1a



- Jemena Gas Pipeline - Tarro Interchange Access - Project Area - Cadastre	- Relief Roads - Swale Drain - Vehicular Access - Indicative Tarro Interchange Disturbance - Compound Area	Vegetation Communities - Coastal Saltmarsh in Estuaries - Exotic Grassland / Disturbed - Exotic Herbfield - Planted Vegetation - Water	<i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands - Swamp Mahogany Swamp Forest on Coastal Lowlands - Swamp Oak Swamp Forest Fringing Estuaries
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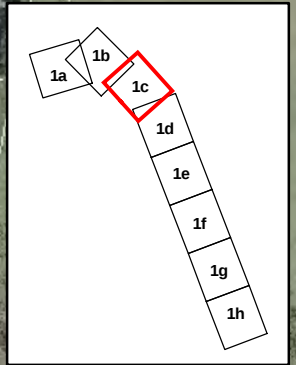
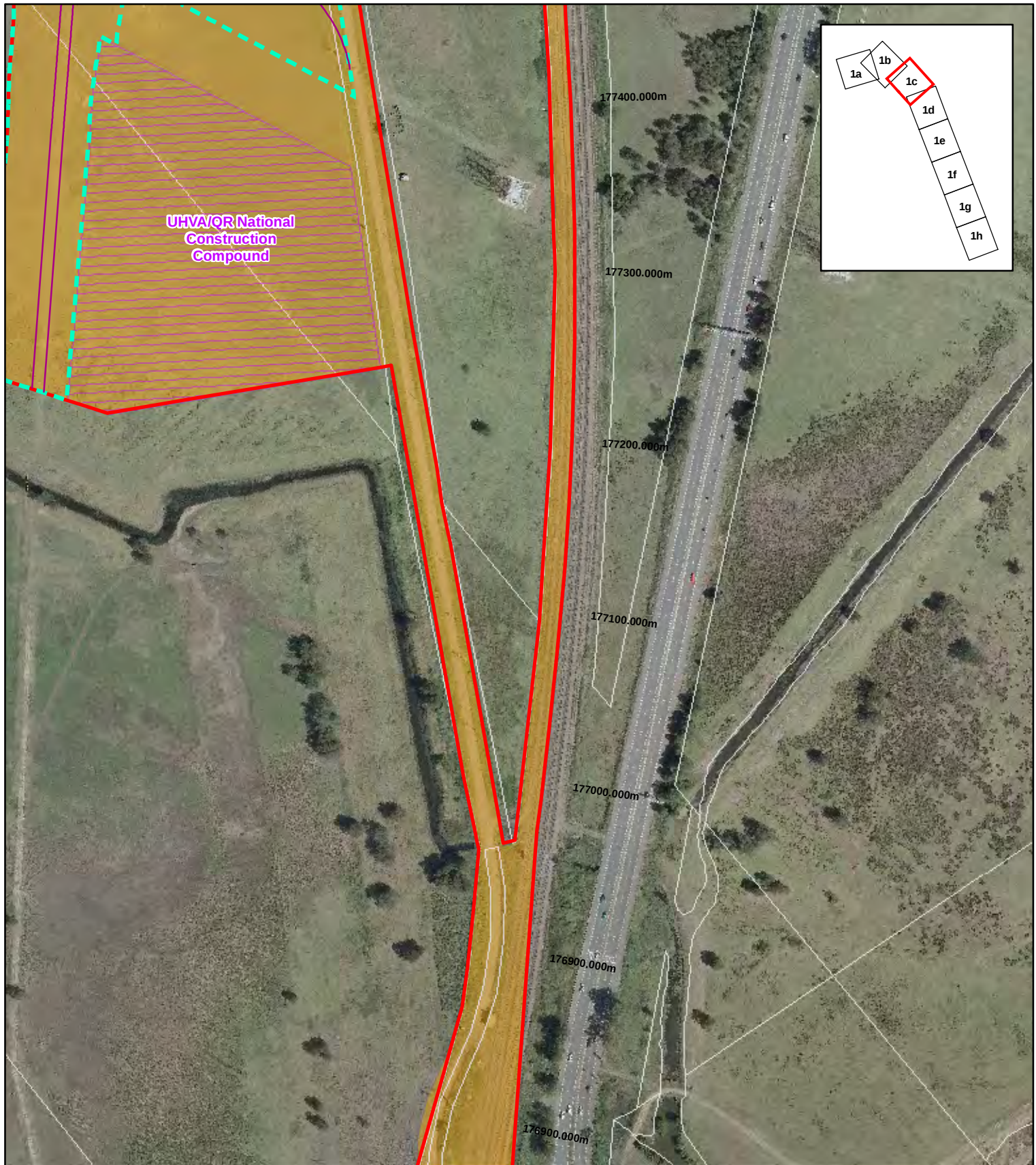
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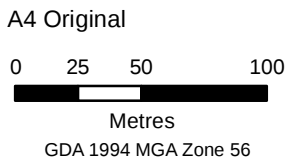
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Hexham Relief Roads
**Tarro Interchange Access
and Site Compound
Vegetation Communities**

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Revision | A2
Date | 02.11.2012
Scale | 1:3,000

Figure 1b



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|---|--|---|---|
| <ul style="list-style-type: none"> Jemena Gas Pipeline Tarro Interchange Access Project Area Cadastre | <ul style="list-style-type: none"> Relief Roads Swale Drain Vehicular Access Indicative Tarro Interchange Disturbance Compound Area | Vegetation Communities <ul style="list-style-type: none"> Coastal Saltmarsh in Estuaries Exotic Grassland / Disturbed Exotic Herbfield Planted Vegetation Water | <ul style="list-style-type: none"> <i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands Swamp Mahogany Swamp Forest on Coastal Lowlands Swamp Oak Swamp Forest Fringing Estuaries |
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ARTC
Hexham Relief Roads
**Tarro Interchange Access
and Site Compound
Vegetation Communities**

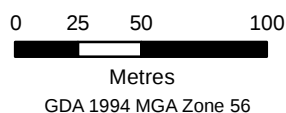
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Revision	A2
Date	02.11.2012
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Figure 1c



••• Jemena Gas Pipeline	— Relief Roads	Vegetation Communities	Phragmites australis and Typha orientalis Coastal Freshwater Wetlands
— Tarro Interchange Access	— Swale Drain	Coastal Saltmarsh in Estuaries	Swamp Mahogany Swamp Forest on Coastal Lowlands
Project Area	— Vehicular Access	Exotic Grassland / Disturbed	Swamp Oak Swamp Forest Fringing Estuaries
Cadastre	Indicative Tarro Interchange Disturbance	Exotic Herbfield	
	Compound Area	Planted Vegetation	
		Water	

A4 Original

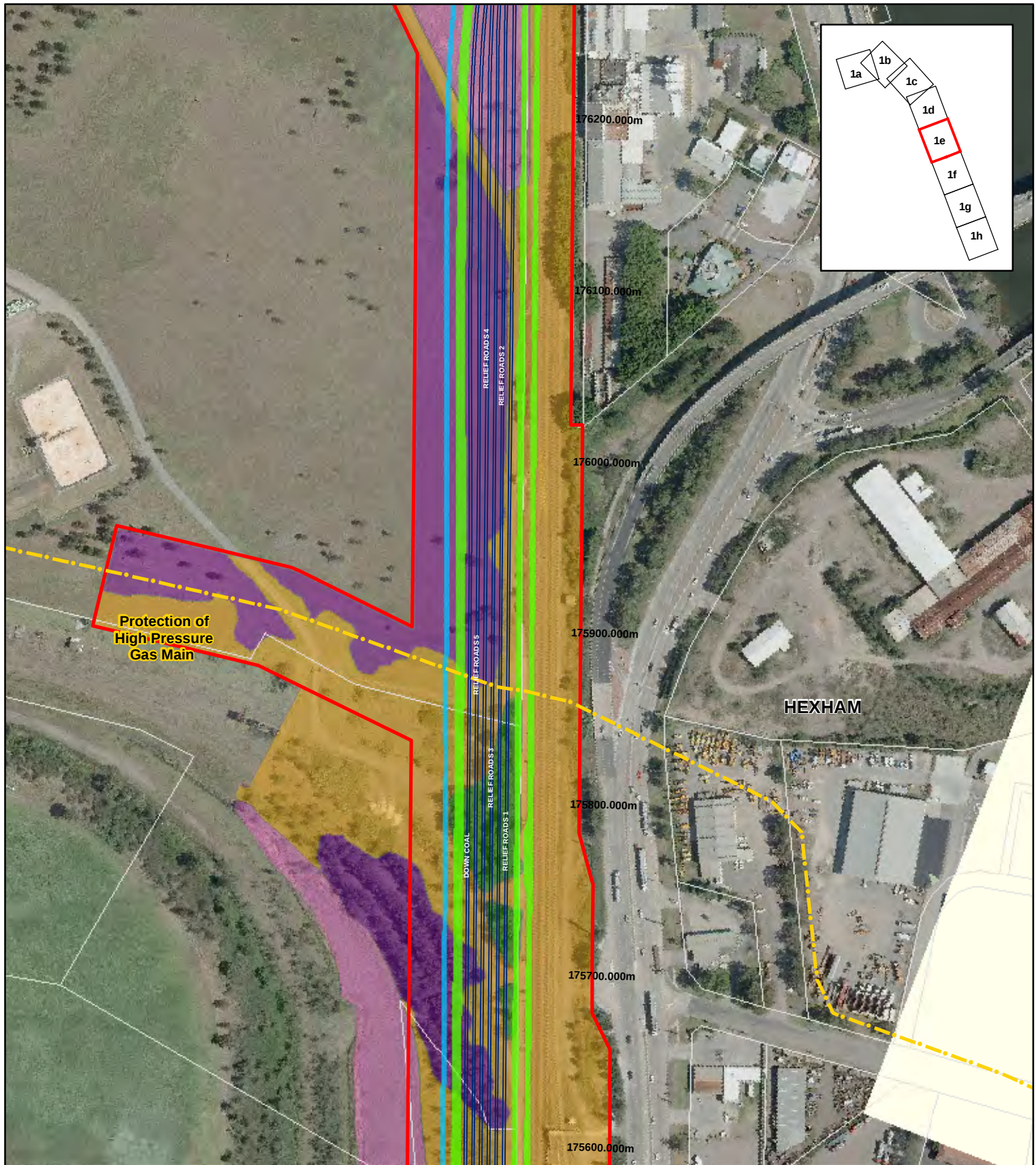


ARTC
Hexham Relief Roads

Tarro Interchange Access and Site Compound Vegetation Communities

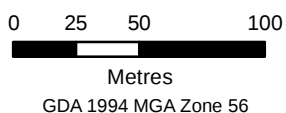
Job Number	2110501B
Revision	A2
Date	02.11.2012
Scale	1:3,000

Figure 1d



Jemena Gas Pipeline	Relief Roads	Coastal Saltmarsh in Estuaries	<i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands
Tarro Interchange Access	Swale Drain	Exotic Grassland / Disturbed	Swamp Mahogany Swamp Forest on Coastal Lowlands
Project Area	Vehicular Access	Exotic Herbfield	Swamp Oak Swamp Forest Fringing Estuaries
Cadastre	Indicative Tarro Interchange Disturbance	Planted Vegetation	
	Compound Area	Water	

A4 Original

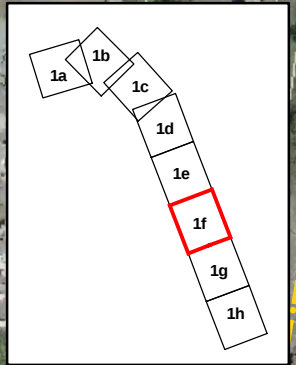
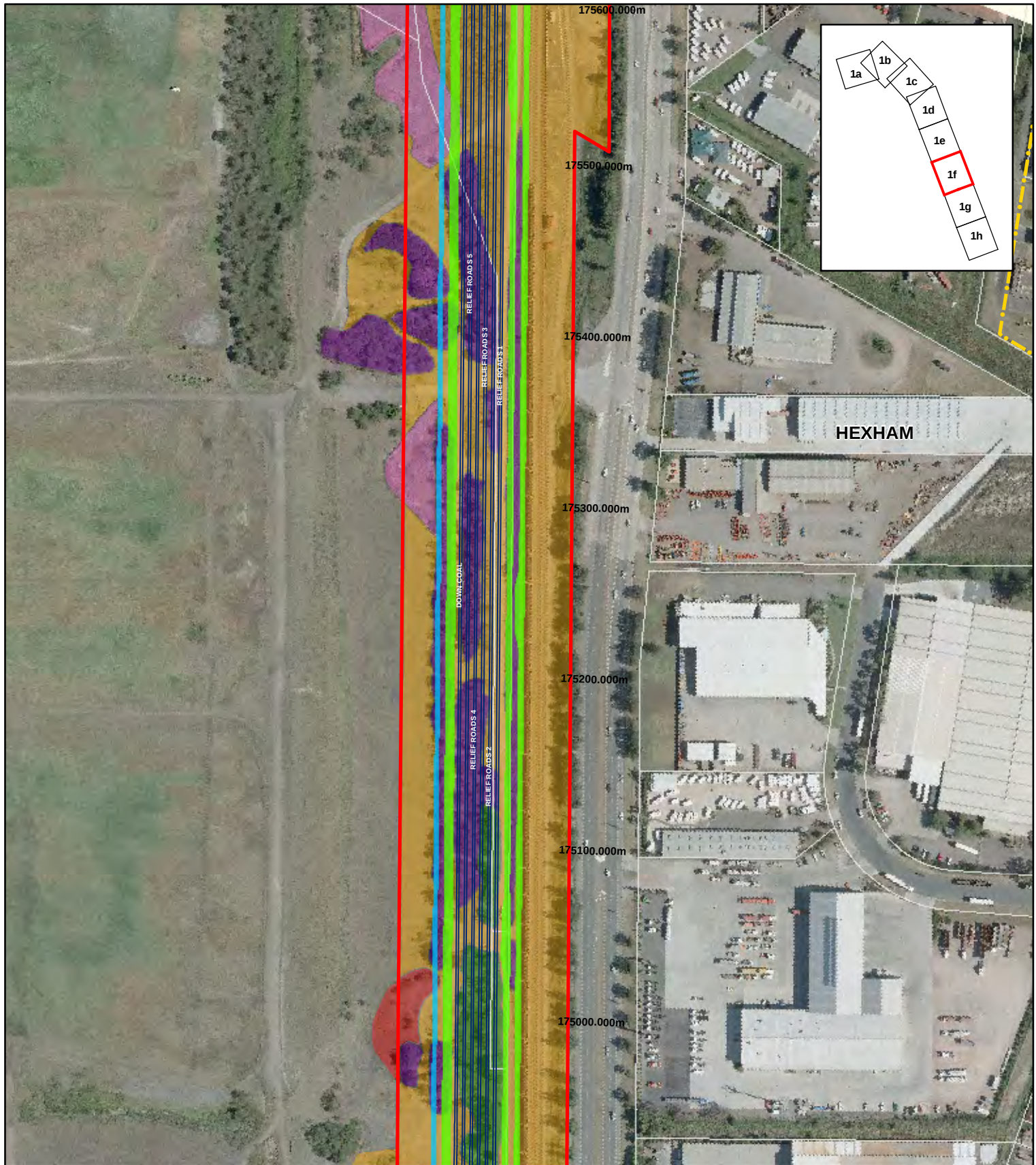


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Hexham Relief Roads

Tarro Interchange Access and Site Compound Vegetation Communities

Job Number	2110501B
Revision	A2
Date	02.11.2012
Scale	1:3,000

Figure 1e



- | | | | |
|---|--|---|---|
| <ul style="list-style-type: none"> Jemena Gas Pipeline Tarro Interchange Access Project Area Cadastre | <ul style="list-style-type: none"> Relief Roads Swale Drain Vehicular Access Indicative Tarro Interchange Disturbance Compound Area | Vegetation Communities <ul style="list-style-type: none"> Coastal Saltmarsh in Estuaries Exotic Grassland / Disturbed Exotic Herbfield Planted Vegetation Water | <ul style="list-style-type: none"> <i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands Swamp Mahogany Swamp Forest on Coastal Lowlands Swamp Oak Swamp Forest Fringing Estuaries |
|---|--|---|---|

A4 Original

0 25 50 100

Metres

GDA 1994 MGA Zone 56

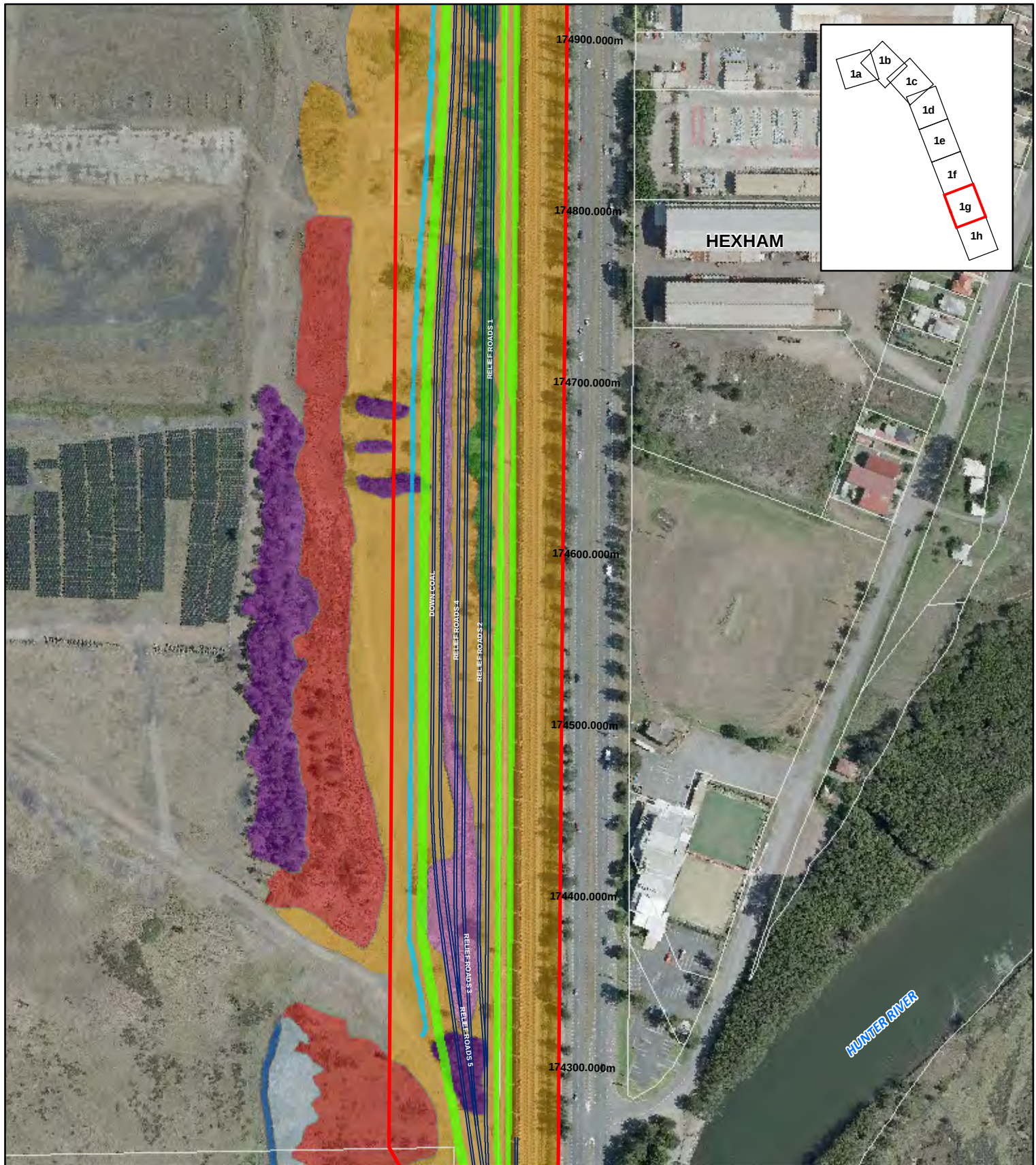


ARTC
Hexham Relief Roads

**Tarro Interchange Access
and Site Compound
Vegetation Communities**

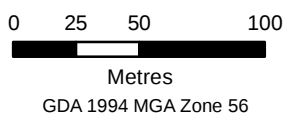
Job Number	2110501B
Revision	A2
Date	02.11.2012
Scale	1:3,000

Figure 1f



- Jemena Gas Pipeline - Tarro Interchange Access - Project Area - Cadastre	- Relief Roads - Swale Drain - Vehicular Access - Indicative Tarro Interchange Disturbance - Compound Area	Vegetation Communities - Coastal Saltmarsh in Estuaries - Exotic Grassland / Disturbed - Exotic Herbfield - Planted Vegetation - Water	<i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands - Swamp Mahogany Swamp Forest on Coastal Lowlands - Swamp Oak Swamp Forest Fringing Estuaries
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A4 Original

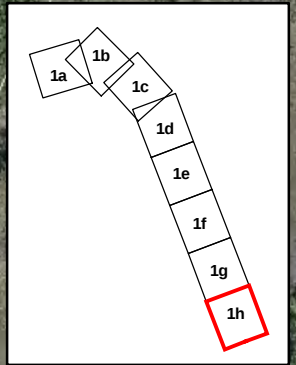
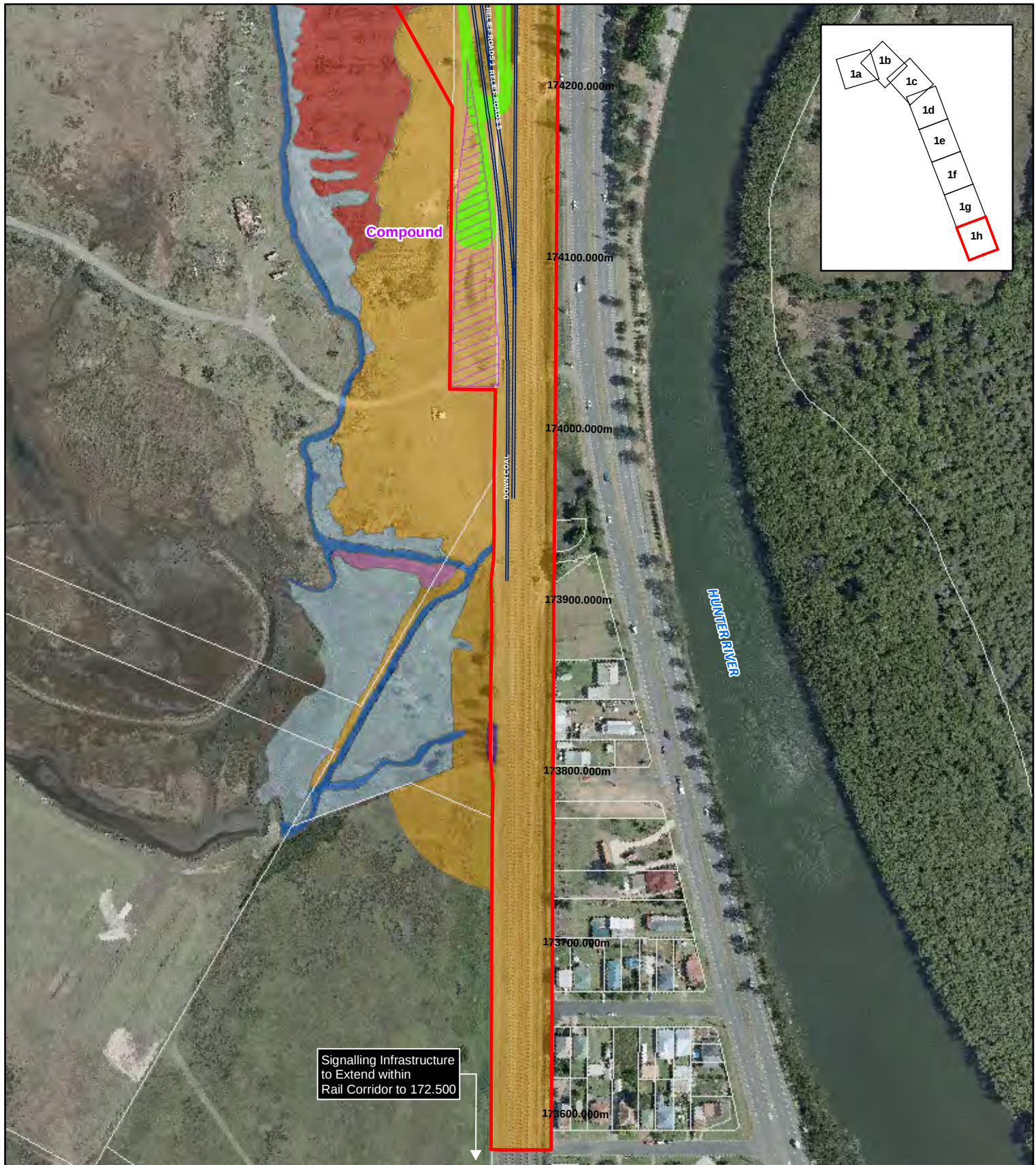


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Hexham Relief Roads

Tarro Interchange Access and Site Compound Vegetation Communities

Job Number	2110501B
Revision	A2
Date	02.11.2012
Scale	1:3,000

Figure 1g



- | | | | |
|---|--|---|---|
| <ul style="list-style-type: none"> Jemena Gas Pipeline Tarro Interchange Access Project Area Cadastre | <ul style="list-style-type: none"> Relief Roads Swale Drain Vehicular Access Indicative Tarro Interchange Disturbance Compound Area | Vegetation Communities <ul style="list-style-type: none"> Coastal Saltmarsh in Estuaries Exotic Grassland / Disturbed Exotic Herbfield Planted Vegetation Water | <ul style="list-style-type: none"> <i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands Swamp Mahogany Swamp Forest on Coastal Lowlands Swamp Oak Swamp Forest Fringing Estuaries |
|---|--|---|---|

A4 Original

0 25 50 100

Metres

GDA 1994 MGA Zone 56



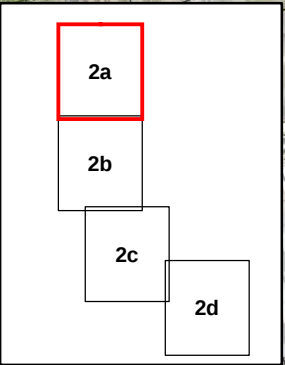
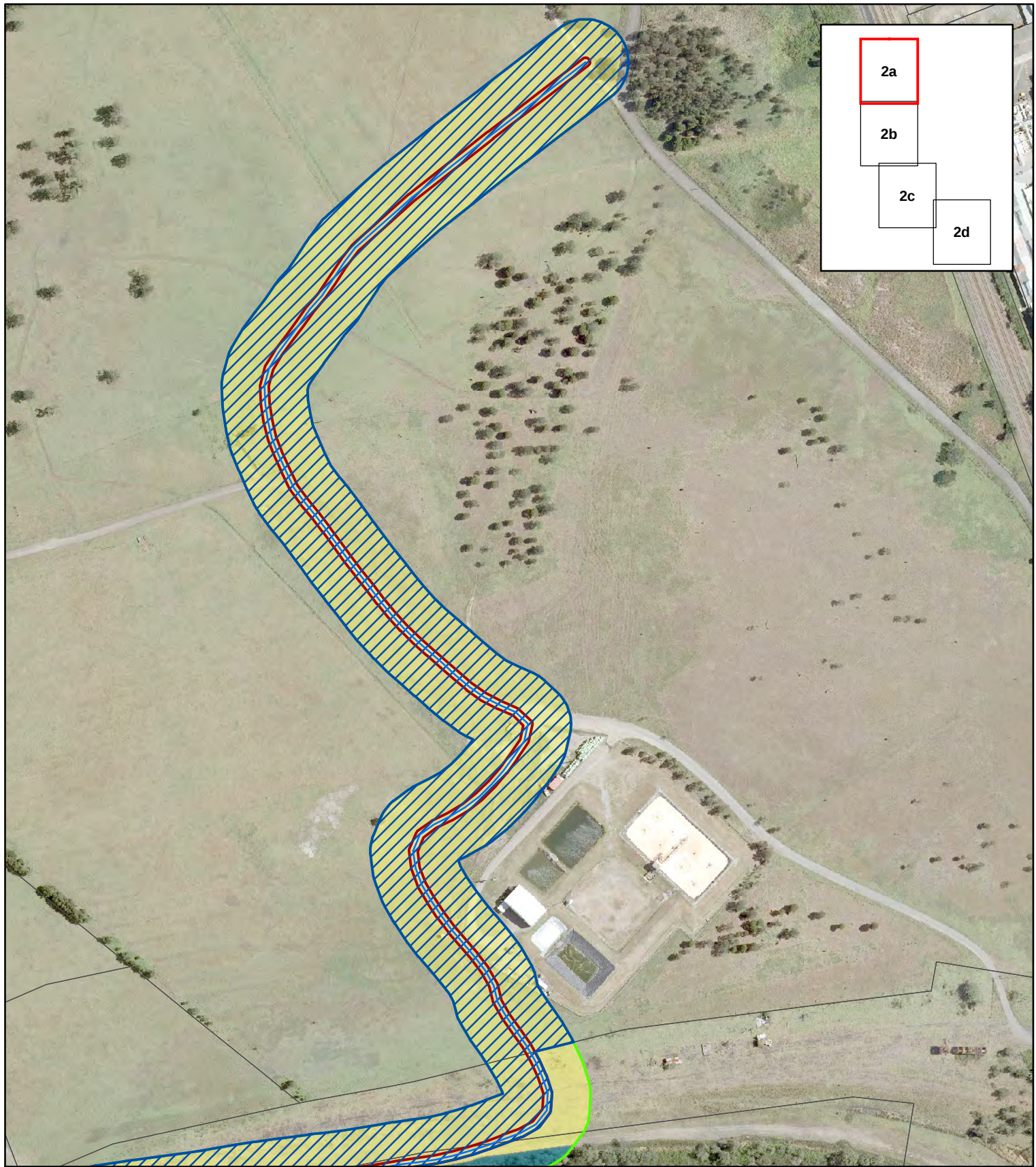
ARTC
Hexham Relief Roads
**Tarro Interchange Access
and Site Compound
Vegetation Communities**

Job Number	2110501B
Revision	A2
Date	02.11.2012
Scale	1:3,000

Figure 1h

Figure 2a-2d

Private Access Track Vegetation
Communities



- | | |
|-----------------------------------|---|
| DeWitt Road Centreline | Exotic Grassland |
| Proposed Road Corridor (5m Width) | Swamp Mahogany Swamp Forest on Coastal Lowlands |
| Study Area (25m Width) | |
| Impact Area | |
| Cadastre | |

A4 Original

0 25 50 100
Metres
GDA 1994 MGA Zone 56

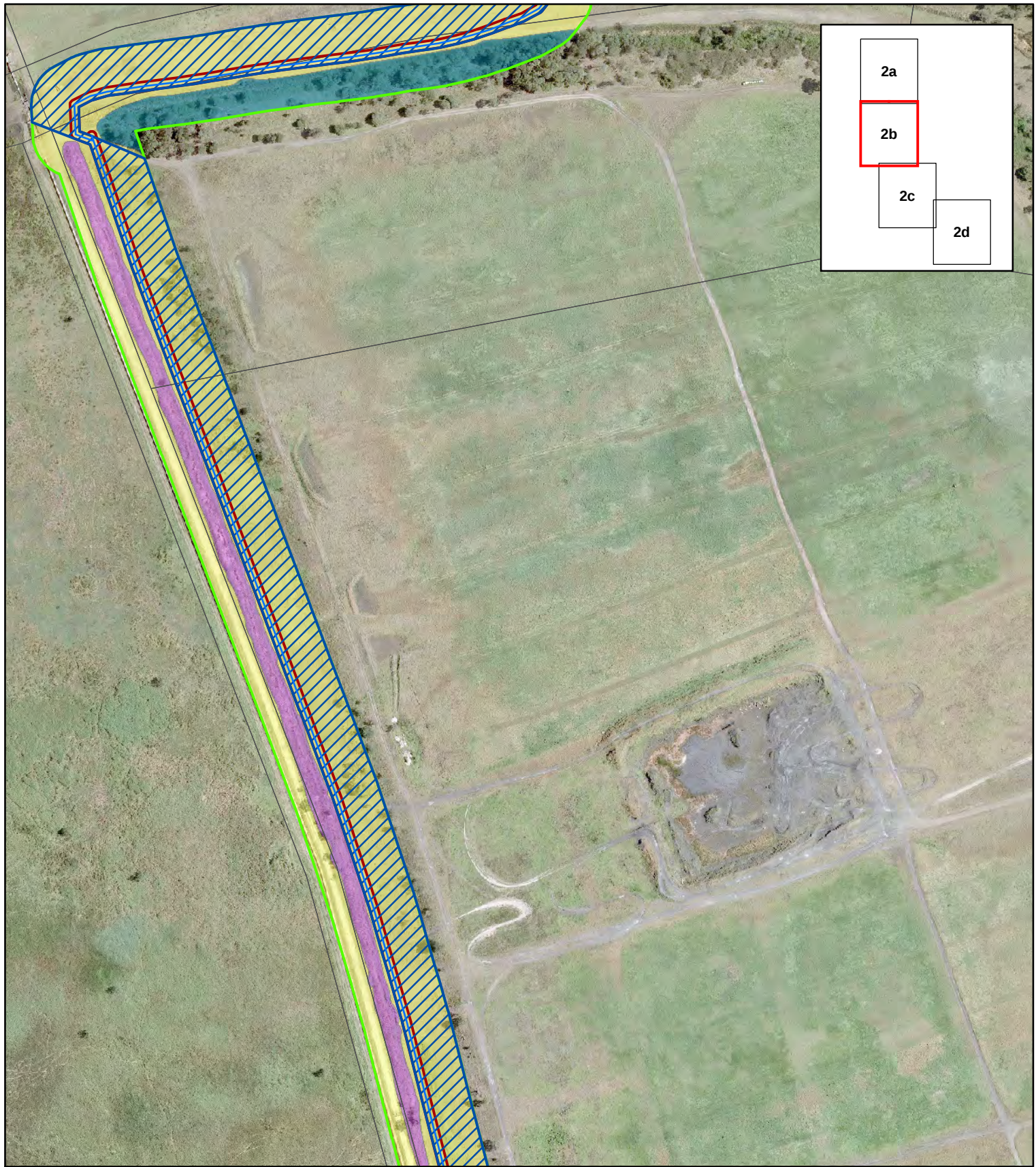


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Hexham Relief Roads

Vegetation Communities

Job Number	2110501B
Revision	A3
Date	05.02.2013
Scale	1:3,000

Figure 2a



- | | |
|-------------------------------------|---|
| — DeWitt Road Centreline | Vegetation Communities |
| — Proposed Road Corridor (5m Width) | Exotic Grassland |
| — Study Area (25m Width) | <i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands |
| — Impact Area | Swamp Mahogany Swamp Forest on Coastal Lowlands |
| — Cadastre | |

A4 Original

0 25 50 100
Metres
GDA 1994 MGA Zone 56

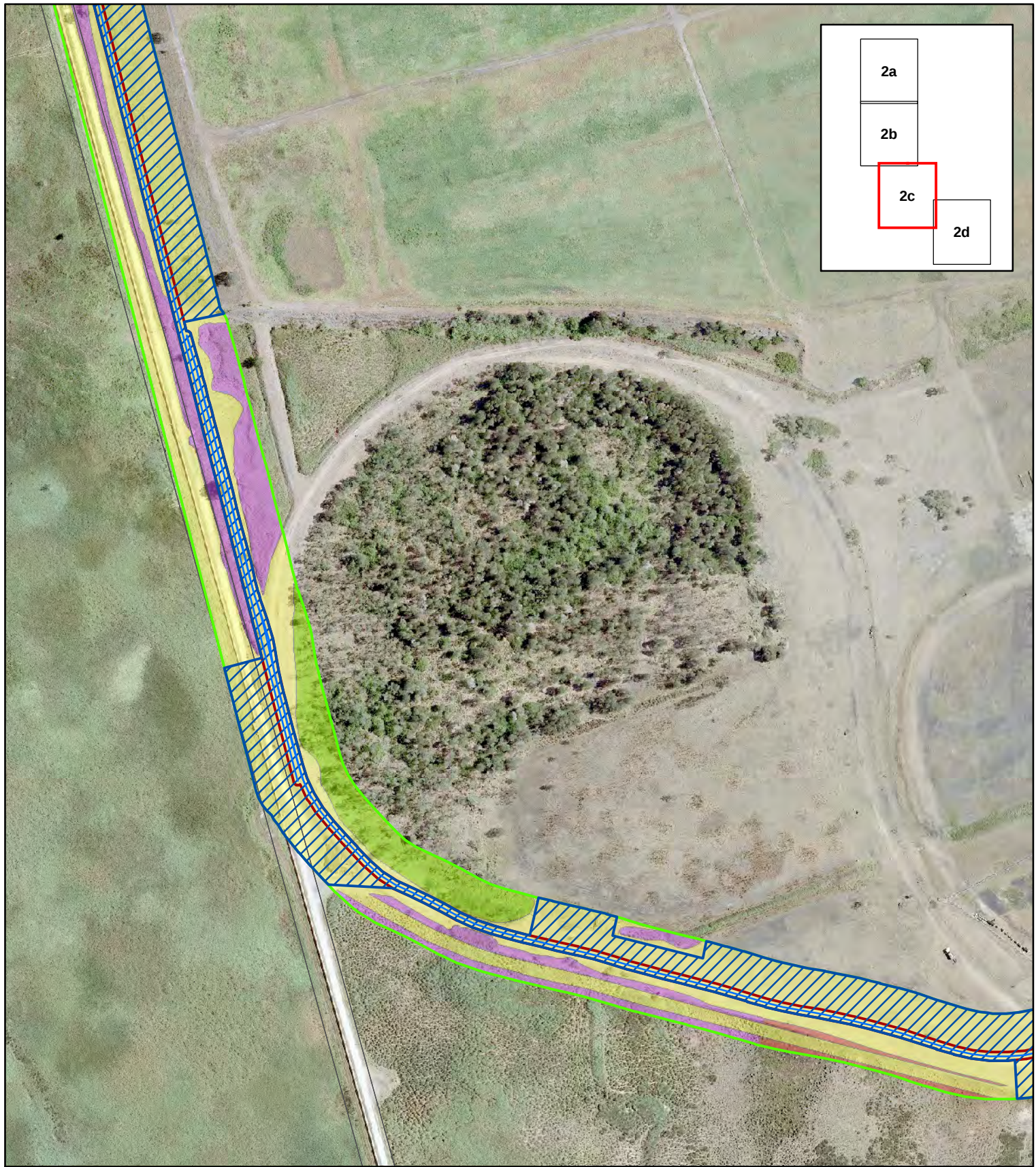


ARTC
Hexham Relief Roads

Vegetation Communities

Job Number	2110501B
Revision	A3
Date	05.02.2013
Scale	1:3,000

Figure 2b



- | | |
|--|--|
| — DeWitt Road Centreline | Vegetation Communities |
| Proposed Road Corridor (5m Width) | Exotic Grassland |
| Study Area (25m Width) | Exotic Herbfield |
| Impact Area | <i>Phragmites australis</i> and <i>Typha orientalis</i> Coastal Freshwater Wetlands |
| Cadastre | Swamp Oak Forest Fringing Estuaries |

A4 Original

0 25 50 100
Metres
GDA 1994 MGA Zone 56

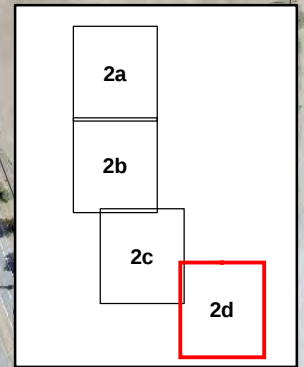
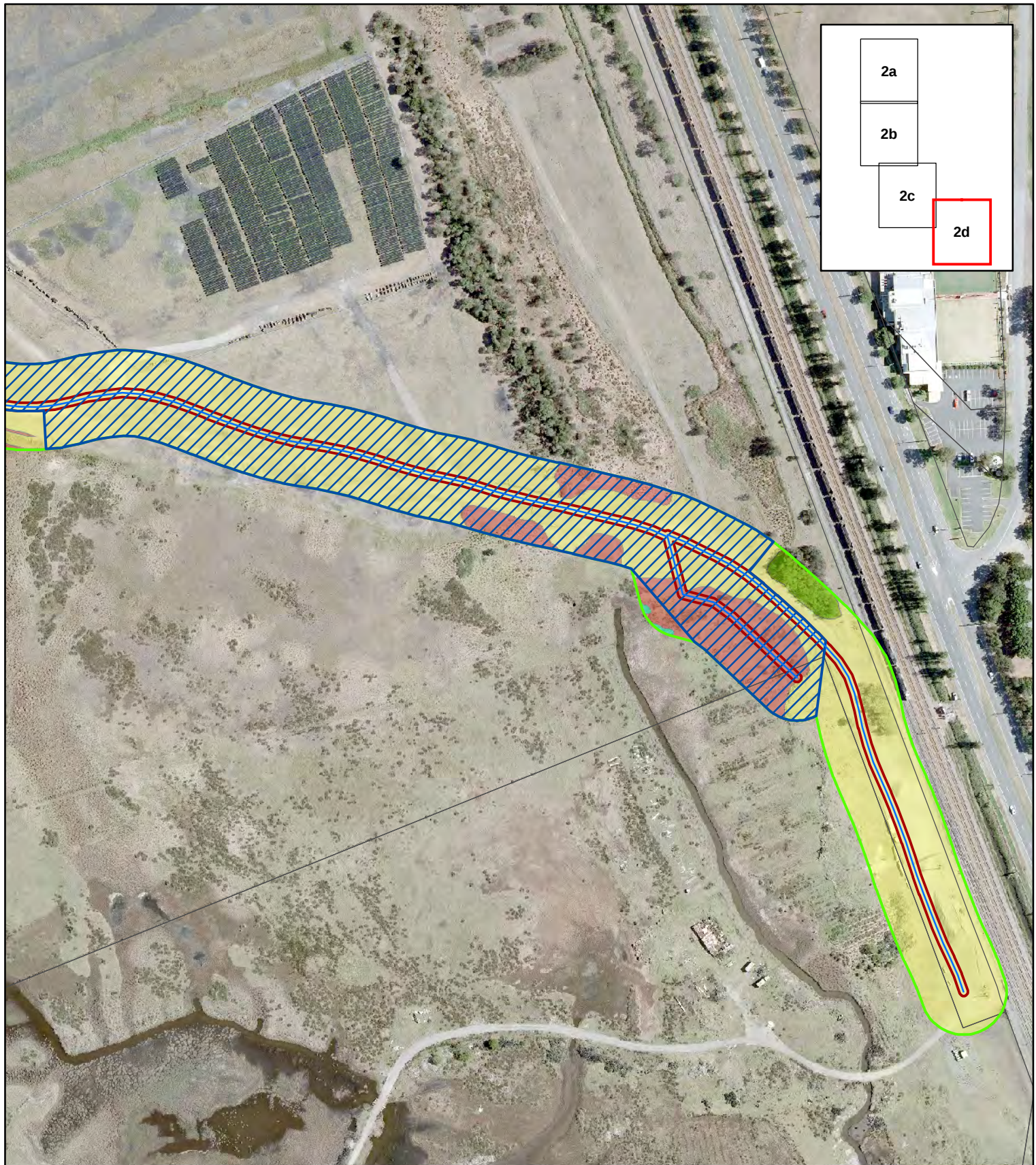


ARTC
Hexham Relief Roads

Vegetation Communities

Job Number	2110501B
Revision	A3
Date	05.02.2013
Scale	1:3,000

Figure 2c



- | | |
|-----------------------------------|-------------------------------------|
| DeWitt Road Centreline | Vegetation Communities |
| Proposed Road Corridor (5m Width) | Coastal Saltmarsh in Estuaries |
| Study Area (25m Width) | Exotic Grassland |
| Impact Area | Exotic Herbfield |
| Cadastre | Swamp Oak Forest Fringing Estuaries |

A4 Original

0 25 50 100

Metres

GDA 1994 MGA Zone 56



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Hexham Relief Roads

Job Number	2110501B
Revision	A3
Date	05.02.2013
Scale	1:3,000

Vegetation Communities

Figure 2d